

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A diffracting structure for use with a microphone array, the microphone array being comprised of a plurality of microphones defining a space generally enclosed by the array wherein a placement of the  
5 structure is chosen from the group comprising:

a) the structure is positioned substantially adjacent to the space;

b) at least a portion of the structure is substantially within the space; and

10 wherein the structure has an outside surface.

2. A structure as claimed in claim 1 wherein a first set of portions of the outside surface of the structure is constructed and arranged to allow air-  
15 coupled surface waves to propagate over the first set of portions.

3. A structure as claimed in claim 2 wherein a second set of portions of the outside surface of the structure is constructed and arranged to absorb and dampen sound.

4. A structure as claimed in claim 1 wherein the outside surface of the structure is constructed and arranged to allow air-coupled surface waves to propagate over the outside surface.

5. A structure as claimed in claim 2 wherein the first set of portions has a cell-like construction.

6. A structure as claimed in claim 4 wherein the outside surface of the structure has a cell-like construction.

7. A structure as claimed in claim 1 wherein the structure has a shape chosen from the group comprising:

- a) hemisphere
- b) right circular cylinder
- 5 c) a cylinder with a star shaped cross section
- d) a square truncated pyramid
- e) an inverted truncated pyramid with a generally square cross section
- f) a right circular cylinder coupled to a
- 10 flattened oblate spheroid at each end of the cylinder
- g) an oblate spheroid
- h) a flat shallow solid cylinder
- i) a shallow solid cylinder with a convex top
- j) generally circular with a convex top
- 15 k) shallow cup shaped cross section
- l) shallow solid cylinder
- m) generally circular with a convex top
- n) hexagonal truncated pyramid and
- o) shallow hexagonal solid cylinder

8. A structure as claimed in claim 7 wherein the outside surface of the structure has a cell-like construction.

9. A structure as claimed in claim 7 wherein the structure is raised from a surface by a support having a shape chosen from the group comprising:

- 5       aa) circular right cylinder
- bb) square cylinder
- cc) flaring cylinder with a narrow portion adjacent to the surface
- dd) a square base attached to a flaring cylinder
- 10     and
- ee) hexagonal cylinder

10. A structure as claimed in claim 9 wherein the outside surface of the structure has a cell-like construction.

- 11. A microphone array comprising:
  - a plurality of microphones constructed and arranged to generally enclose a space; and
  - a diffracting structure placed such that at least
- 5     a portion of the structure is adjacent to said space and wherein the diffracting structure has an outside surface.

12. An array as claimed in claim 11 wherein at least a portion of the structure is substantially within the space.

13. An array as claimed in claim 11 wherein a first set of portions of the outside surface of the structure is constructed and arranged to allow air-

coupled surface waves to propagate over a first set of portions.

14. An array as claimed in claim 13 wherein a second set of portions of the outside surface of the structure is constructed and arranged to absorb and dampen sound.

15. An array as claimed in claim 11 wherein the outside surface of the structure is constructed and arranged to allow air-coupled surface waves to propagate over the outside surface.

16. An array as claimed in claim 13 wherein the first set of portions has a cell-like construction.

17. An array as claimed in claim 15 wherein the outside surface of the structure has a cell-like construction.

18. An array as claimed in claim 11 wherein a shape of the structure is chosen from the group comprising:

- a) hemisphere
- 5 b) right circular cylinder
- c) a cylinder with a star shaped cross section
- d) a square truncated pyramid
- e) an inverted truncated pyramid with a generally square cross section
- 10 f) a right circular cylinder coupled to a flattened oblate spheroid at each end of the cylinder
- g) an oblate spheroid and
- h) a flat shallow solid cylinder

- 15 i) a shallow solid cylinder with a convex top  
j) generally circular with a convex top  
k) shallow cup shaped cross section  
l) shallow solid cylinder  
m) generally circular with a convex top  
n) hexagonal truncated pyramid and  
20 o) shallow hexagonal solid cylinder  
and wherein the plurality of microphones is arranged in  
a configuration chosen from the group comprising:  
a) generally circular  
b) generally bi-circular  
25 c) generally tetrahedral  
d) triangular  
e) bi-triangular.

19. An array as claimed in claim 18 wherein the outside surface of the structure has a cell-like construction.

20. An array as claimed in claim 19 wherein the structure is raised from a surface by a support having a shape chosen from the group comprising:

- 5 aa) right circular cylinder  
bb) square cylinder  
cc) flaring cylinder with a narrow portion adjacent  
to the surface  
dd) a square base attached to a flaring cylinder  
10 and  
ee) hexagonal cylinder

21. An array as claimed in claim 20 wherein the outside surface of the structure has a cell-like construction and wherein the microphones are disposed within the cells.

22. A method of increasing an apparent aperture size of a microphone array, the method comprising:

- a) positioning a diffraction structure within a space defined by the microphone array to extend a travel time of sound signals to be received by microphones in the microphone array;
- b) generating different time delay weights, phases, and amplitudes for signals from each microphone in the microphone array;
- c) applying said time delay weights to said sound signals received by each microphone in the microphone array

wherein

- the diffraction structure has a shape;
- said time delay weights are determined by analyzing the shape of the diffraction structure and the travel time of the sound signals.

23. A method as claimed in claim 16 wherein the shape of the structure is chosen from the group comprising:

- a) hemisphere
- b) right circular cylinder
- c) a cylinder with a star shaped cross section
- d) a truncated square pyramid
- e) an upside down truncated square pyramid

- 10 f) a right circular cylinder coupled to a flattened  
oblate spheroid at each end of the cylinder  
g) an oblate spheroid  
h) a flat shallow solid cylinder  
i) a shallow solid cylinder with a convex top  
j) generally circular with a convex top  
15 k) shallow cup shaped cross section  
l) shallow solid cylinder  
m) generally circular with a convex top  
n) hexagonal truncated pyramid and  
o) shallow hexagonal solid cylinder

24. A method as claimed in claim 22 further including constructing and arranging a first set of portions of an outside surface of the diffraction structure to allow air-coupled surface waves to  
5 propagate over the first set of portions.

25. A method as claimed in claim 24 further including constructing and arranging a second set of portions of the outside surface of the diffraction structure to absorb and dampen the sound signals.

26. A method as claimed in claim 22 further including constructing and arranging an outside surface of the diffraction structure to allow air-coupled surface waves to propagate over the outside surface.

27. A method as claimed in claim 24 further including constructing and arranging the first set of portions of the surface of the diffraction structure to have a cell-like construction.

28. A method as claimed in claim 26 further including constructing and arranging the outside surface of the diffraction structure to have a cell-like construction.

29. A microphone array for use on a generally flat surface comprising:

a body having a convex top and an inverted truncated cone for a bottom;

5 a plurality of cells located on a surface of the bottom for producing an acoustic impedance; and

a plurality of microphones located adjacent to the bottom.

30. A microphone array as claimed in claim 29 wherein each of the plurality of microphones is placed inside a cell chosen from the plurality of cells.

31. A microphone array as claimed in claim 29 further including a speaker located substantially in a center of the convex top.

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